

Novel technology for fabrication of probe tips for SPM using focused ion beam induced deposition method

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Scanning probe microscopy (SPM) is currently one of the main methods for obtaining information about the structure and local properties of the surface. The accuracy and resolution of research using SPM methods is largely determined by the parameters of the probes used. Special SPM methods, such as near-field optical microscopy (SNOM) and vertical wall microscopy (CD AFM), require the use of specialized-shaped probes, the production of which is technologically difficult. Using modern methods of forming nanostructures, it is possible to form the tips of the probes of complex shape. One of the most promising today methods for the formation of nanoscale structures is ion-stimulated deposition of materials from the gas phase using a focused ion beam (FIB) Ga⁺. The FIB method makes it possible to perform technological operations of local ion-beam etching and ion-stimulated deposition of materials under high vacuum conditions without the need for resists, masks and chemical etchants [1].

In the present work, experimental studies of the effect of the parameters of ion-stimulated deposition by the FIB method on the geometric parameters of the formed nanoscale structures are carried out. In the course of experimental studies, the optimal values of the accelerating voltage, the ion beam current, the time of beam impact at a point and the degree of overlap of neighboring impact points (Fig.1), at which the parameters of the formed structures corresponded to the specified, were determined.

Based on the data obtained, probes with high aspect ratios were formed for the AFM and the CD-AFM technique (Fig. 2).

The results obtained in the study can be used in the development of technological processes for the manufacture and modification of special probes for atomic force microscopy, including probes CD-AFM.

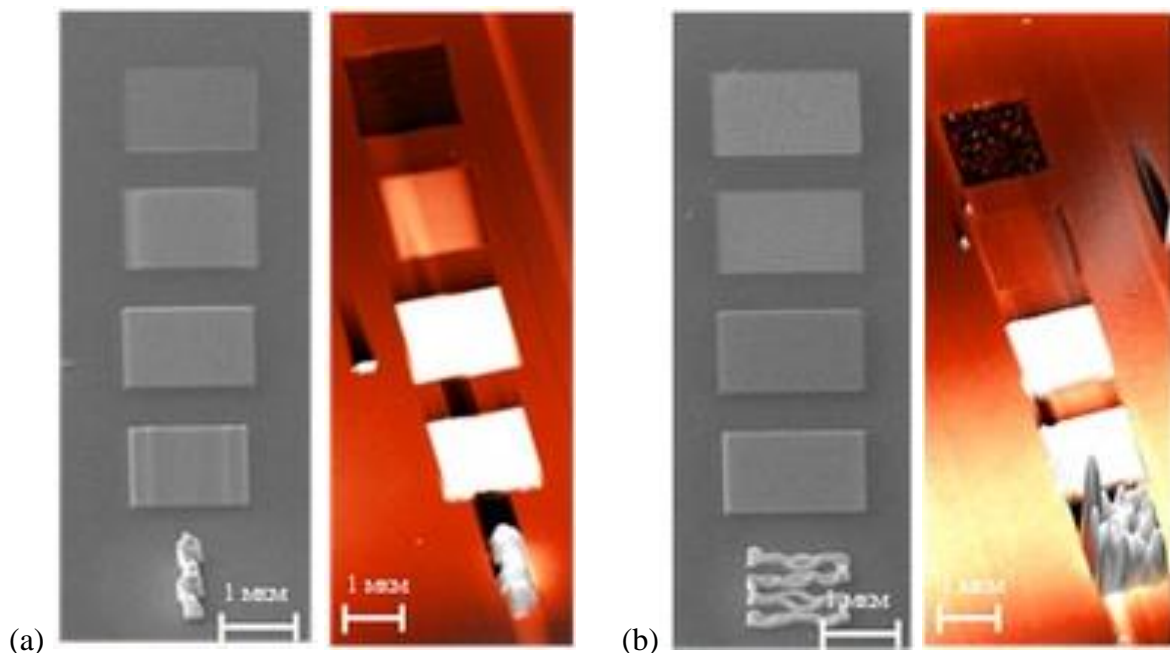


Figure 1. The example of influence of beam overlap on the deposition process (10 ms dwell time, 8 pA beam current): (a) 5 nm, (b) 10 nm.

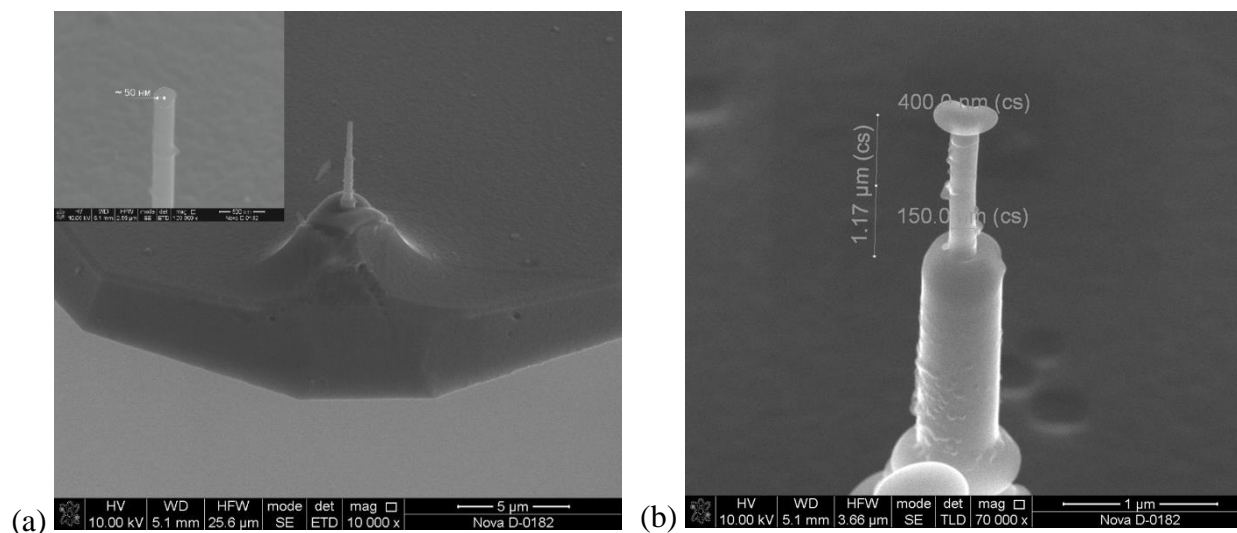


Figure 2. SEM images of AFM (a) and CD AFM (b) probe tips, fabricated by focused ion beam deposition of carbon.

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1. O.A. Ageev, A.S. Kolomiitsev, B.G. Konoplev, N.I. Serbu, V.A. Smirnov, *Russ. Microelectr.* **41**, 41 (2012).